U.S. DEPARTMENT OF THE INTERIOR SCIENTIFIC INVESTIGATIONS MAP 3425 U.S. GEOLOGICAL SURVEY Explanatory pamphlet accompanies map Ontario Lowlands ► Plateau province SEVERNE WATKINS-BEAVER LODI POINT VAN ETTEN DAMS ANTICLINE **ANTICLINE** ANTICLINE ANTICLINE **ANTICLINE** ANTICLINE **GLENORA** SYNCLINE COHOCTON CORBETT POINT UNNAMED SYNCLINE SYNCLINE SYNCLINE SYNCLINE SYNCLINE Bend in section Bend in section Bend in section Tuscarora MILES 0 E.F. Blair and Associates NYS Natural Gas Company E.F. Blair and Associates Bowdoin Storage Service Inc. NYS Natural Gas Company William Duchscherer, Jr. No. 1 J. Klotzbach API No. 31-037-05117 No. 1 L. Tyler API No. 31-037-04593 No. 1 Arthur N. Kennedy API No. 31-051-04630 No. 1 Albert McClurg No. 1 Hubbard No. 1 Robert Olin API No. 31-101-03924 API No. 31-101-21496 API No. 31-051-04552 Genesee Co., New York Genesee Co., New York Livingston Co., New York Livingston Co., New York Steuben Co., New York Steuben Co., New York and Bois Blanc Java Formation West Falls Formation Mean sea level (MSL) Gardeau Shale, Grimes West Falls Formation Siltstone, and Hatch → Shale Members and the Tully Limestone is not shown to the northwest of drill hole 5 because the Tully is thinner than the Lorraine Shale Utica Shale Trenton Group (und.) Millbrig Bentonite Bed Deicke Bentonite Bed Black River Group (und.)— Galway Formation TD 3,950 ft Lorraine Shale Utica Shale CLARENDON-LINDEN FAULT SYSTEM UNNAMED NORTHWEST TRENDING FAULT Trenton Group (und.) (Rickard, 1973; Van Tyne, 1975; Fakundiny and of Jacobi (2002); may be related to the Georgian Pomeroy, 2002; and Jacobi, 2002); sense of Bay linear zone; negligible vertical displacement throw and amount of vertical displacement are above the Trenton Group; possibly up to 20 feet based on Van Tyne's (1975) cross section *C-D* of vertical displacement below the Utica Shale (R.D. Jacobi, oral commun., 2016) LEROY FAULT of Jacobi (2002) and Rickard (1973); possibly up to 75 feet of vertical displacement down-to-the-southeast below the Metamorphic and igneous basement rocks of the subsurface extension of the Utica Shale; fracture swarms indicate RETSOF FAULT that the fault may continue to the surface Grenville province (1,350–950 Ma) of Jacobi (2002); possibly up to (Rankin and others, 1993) (R.D. Jacobi, oral commun., 2016) 40 feet of vertical displacement Queenston Shale down-to-the-northwest below the Utica Shale; fracture swarms indicate that the fault may continue to the surface (R.D. Jacobi, oral commun., 2016) Oswego Sandstone Lorraine Shale **EXPLANATION** SEDIMENTARY ROCKS LITHOLOGIC MODIFIERS OTHER SYMBOLS Utica Shale (Used in conjunction with dominant lithology) Dominant Lithology Trenton Group (und Red conglomeratic sandstone (litharenite) Contact—Dashed where inferred; bentonite beds shown in red Informal marker bed—Dashed where inferred Sandstone marker bed Group (und.) Argillaceous, gray and (or) green UNNAMED FAULTS Arbitrary lateral boundary of rock-stratigraphic unit of Jacobi (2002); may be the western FEET METERS extensions of the Glodes Corners Road Argillaceous, red shale graben faults and Muck Farm graben Normal fault—Dashed where inferred; arrow shows relative movement faults that are 10 to 20 miles east of Coal bearing cross section A-A'; vertical displacement Galway Formation Normal fault with later episodes of reverse motion (inversion) and vertical extent are unknown 1500 -Dark gray to black shale Thrust or bedding plane fault of the Alleghanian orogeny Δ Δ Δ Cherty Gray and (or) green shale Gamma-ray log curve—Units and scales vary; see appendix 2 in explanatory pamphlet BOLIVAR FAULT SYSTEM of Jacobi (2002); fault in the Silurian salt may lie above a deeper fault that affects Precambrian basement (R.D. Jacobi, oral commun., 2016); vertical displacement and vertical extent are unknown IGNEOUS AND METAMORPHIC ROCKS 15 KILOMETERS KEUKA LAKE SPLAY FAULT Granite and (or) gneiss of Jacobi (2002) (not shown Vertical exaggeration approximately 16X above on cross section); may affect Precambrian basement; vertical displacement and vertical extent are unknown LAWRENCEVILLE-ATTICA LINEAMENT of Jacobi (2002) (not shown above on *From L.B. Smith (2012) cross section due to the complexity from both regional dip and two anticline syncline pairs); southeast extension of the Attica-Lockport and Folsomdale faults; may be a northwest striking monocline and (or) fault; the Onondaga Limestone may have a vertical displacement of at least 150 meters to the southwest; only affects units above the Salina Formation ROME TROUGH NORTHWEST-BOUNDARY (R.D. Jacobi, oral commun., 2016) NORMAL BASEMENT FAULT of Beardsley and Cable (1983), Harper (1989), and Jacobi (2002); southeast side downthrown (M.S. Valley and Ridge province Cable, written commun., 1990); amount of Ontario Lowlands province Allegheny Plateau province vertical displacement is unknown. The Kane Arch (southeast of Jersey Shore fault) (named by Ryder, 1992) is to the northwest and follows the Kane gravity high of Tioga, Potter, and Clinton Clinton and Lycoming North American Genesee County, New York Livingston County, New York Steuben County, New York Diment and others (1980) Age (Ma) Eon Era System International European Series International Counties, Pennsylvania Counties, Pennsylvania American American sequences modified (including drill holes 3–4) (including drill holes 1–2) (including drill holes 5–6) Series Stage (including drill hole 10) (including drill holes 7–9) from Sloss (1988) Missourian Stephanian Kasimovian Absaroka Allegheny Formation Moscovian 16,000 -Westphalian Bashkirian Morrowan Upper Lower Pennsylvanian unconformity Serpukhovian Chesterian 17,000 — Meramecian Kaskaskia Tournaisian Kinderhookian 359.2-~ Catskill Formation Chautauquan Famennian Kaskaskia Senecan Frasnian Eifelian Emsian 397.5-Oriskany Sandstone Deer Park³ Pragian Lower to Middle Devonian Lower to Middle Devonian Wallbridge unconformity Wallbridge unconformity_ Helderberg Lochkovian 416.0-Bertie Dolomite Syracuse Salt Bertie Dolomite Keyser

Non Shale Salina Group Vernon Shale Salina Group Vernon Shale Bloomsb Cayugan⁴ Ludfordian 418.7-Ludlow 422.9-Lockport Group Lockport Group Lockport Group Wenlock Niagaran⁴ Telychian Rose Hill Formation Llandovery Aeronian/Rhuddanian Tuscarora Formation Hirnantian Ashgillian Cincinnatian Katian⁶ Caradocian Mohawkian Sandbian⁶ ^{ırin-} Blackriveran⁵ Darriwilian Whiterockian Middle Bellefonte Formation (upper part) Dapingian⁶ Arenigian Floian⁶ Knox unconformity Knox unconformity Knox unconformity Ibexian Tremadocian Tremadocian Trempealeauan² \ A sandstone unnamed Franconian² Furongian Galway Formation Galway Formation Croixian² Dresbachian² Potsdam Sandstone Sauk Middle unnamed Albertan² Basal Cambrian unconformity Basal Cambrian unconformity Basal Cambrian unconformity Waucoban² Basal Cambrian unconformity Basal Cambrian unconformity Metamorphic and igneous basement rocks of the subsurface extension of the Grenville province 、〈\〈\ (1,350–950 Ma) 〈 ` (Rankin and others, 1993) ¹Heckel and Clayton (2006). ⁴Brett and others (1995). ²Harland and others (1990). ⁵Webby (1995). ³Ver Straeten and Brett (2006). ⁶International Commission on Stratigraphy (2014). Ages are for boundaries only. There is no uniform scale for this chart Figure 3.—Correlation chart of Proterozoic and Paleozoic rocks along cross section A-A' in New York and Pennsylvania. Geologic time scale ages are from Gradstein and others (2004) except as noted. Abbreviations are as follows: Fm., Formation; L, Lower; Ls., Limestone; M, Middle; Ma, mega-annum (million years before present); Mbrs., Members; Sh., Shale; U, Upper; und., undivided; ?, unknown or questionable. Any use of trade, product, or firm names in this publication is for descriptive purposes only and does GEOLOGIC CROSS SECTION A-A' THROUGH THE APPALACHIAN BASIN FROM THE SOUTHERN MARGIN OF THE ONTARIO LOWLANDS PROVINCE, not imply endorsement by the U.S. Government http://store.usgs.gov; 1-888-ASK-USGS (1-888-275-8747) GENESEE COUNTY, WESTERN NEW YORK, TO THE VALLEY AND RIDGE PROVINCE, LYCOMING COUNTY, NORTH-CENTRAL PENNSYLVANIA Suggested citation: Trippi, M.H., Ryder, R.T., and Enomoto, C.B., 2019, Geologic cross section A-A' through the Appalachian basin from the southern margin of the Ontario Lowlands province, Genesee County, western New York, to the Valley and Ridge province, Lycoming County, north-central Pennsylvania: U.S. Geological Survey Scientific Investigations Map 3425, 2 sheets, 74-p. pamphlet,

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